

How to Avoid the Osmotic Effect

In the tilt-up industry the “Osmotic Effect” refers to migration of water out of a tilt-up panel and into the casting slab during the critical panel concrete hydration process.

A gradient is formed when wet concrete from a freshly poured panel is cast against a casting slab with a lower water content. This results in water being drawn out of the panel and into the casting slab through a process called osmosis. The moisture concentration difference between the panel and casting slab is directly related to the osmotic force or pressure attained to reach equilibrium between the two slabs.

The occurrence of osmosis is further exacerbated by the force of gravity which naturally pulls water out of the panel and into the casting slab as well as by a temperature gradient which often exists between cooler freshly placed concrete and a warmer casting slab. As the casting slab cools, water is naturally drawn out of the panel and into the casting slab.

The “Osmotic Effect” is the incomplete hydration of the cement on the down side panel surface resulting from the loss of water due to migration into the casting slab through osmosis. Damage caused by the “Osmotic Effect” can range from minor panel surface defects such as dusting to complete skin pull-off as deep as 1/16 inch in depth in the more severe cases.

Nox-Crete Products Group has devoted an enormous amount of time conducting field research on the cause and corrective action necessary to prevent the “Osmotic Effect”. The most effective means for preventing the “Osmotic Effect” is to eliminate the gradient differential by saturating the casting slab with water prior to the placement of the panel concrete and to use a chemically active breathable type cure and bondbreaker.

Saturating the casting slab thoroughly with water before placement of the panel concrete increases the water concentration in the casting slab thereby effectively eliminating osmosis from occurring by eliminating the gradient. Field results indicate a reduction in the “Osmotic Effect” with an increase in downside panel surface strength. It should be noted that a light fogging of the casting slab with water immediately prior to the placement of the panel concrete showed only slight reduction in the “Osmotic Effect”. Best results were achieved when the casting slab was thoroughly saturated with water prior to panel concrete placement. Excess water on the casting slab must be removed immediately prior to the panel concrete placement to avoid the reverse effect of too much water which can result in surface dusting.

In addition to saturating the casting slab with water, it is equally important to choose the right cure and bondbreaker. Best results are achieved if a chemically active, breathable type cure and bondbreaker is selected. Chemically active cure and bondbreakers reduce water migration through the bondbreaker while also permitting vapor transmission. Acrylic or hydrocarbon resin type membrane forming cure and bondbreakers form barriers which prevent water penetration, but also restrict water vapor transmission. Chemically active **SILCOSEAL Cure and Bondbreaker**, properly applied to a uniform surface accumulation, will reduce the penetration of mixing water into the casting slab without significantly affecting water vapor transmission through the surface. In addition, due to their ability to breath, casting slab surfaces coated with **SILCOSEAL Cure and Bondbreaker** provide excellent weatherability and are not subject to peeling, blistering, or delamination when exposed to rain water prior to placement of panel concrete.

The use of silicate based hardeners, sealers, and dustproofers, such as **DURO-NOX**, used in conjunction with **SILCOSEAL Cure and Bondbreaker** have also been shown to provide excellent resistance to the “Osmotic Effect”. Silicate based sealers react with hydrated lime within the casting slab to help densify, harden, and reduce the porosity of the casting slab surface. The application of **DURO-NOX** to the casting slab surface immediately following joint saw cutting, followed by an application of **SILCOSEAL Cure and Bondbreaker** effectively cures and seals the casting slab surface thereby reducing the opportunity for osmosis to occur.

With very porous casting slabs, successive applications of **SILCOSEAL Cure and Bondbreaker** may not be adequate to form sufficient surface holdout. In this instance, the casting slab surface should be saturated with water with the excess water squeegeed off immediately prior to a reapplication of the bondbreaker.

In summary, to prevent the “Osmotic Effect” and the resulting incomplete hydration caused by water migration into the casting slab, it is necessary to stop the diffusion of water through the bondbreaker. This is best accomplished by saturating the casting slab with water prior to the placement of the panel concrete in conjunction with the application of a breathable chemically active cure and bondbreaker such as **SILCOSEAL Cure and Bondbreaker**.